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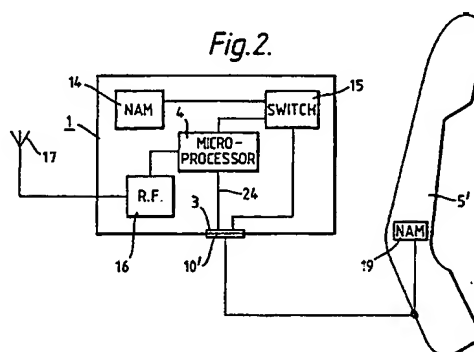
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(54) **Radio telephone.**

(57) A cellular radio telephone comprises a mobile cellular telephone (1) adapted to have a handset (5') containing a number assignment module, i.e. a NAM (19), removably connected thereto. The mobile telephone (1) has a microprocessor (4) which can access the information stored in the NAM (19) of the handset (5') either directly or via a memory 16 whereby the mobile automatically assumes the telephone number of the handset when connected to the mobile telephone (1). Hence the same mobile telephone may be used as a host at different times by any number of subscribers having their own handsets. Each subscriber will be able to receive his own calls and the charges for using the system can be levied to the appropriate subscriber's account.



**EP 0 406 985 A2**

## RADIO TELEPHONE

This application is a divisional of published European patent application No. 0,378,450 (Our ref: PAT 89002aEP).

The present invention relates to a radio telephone system, particularly but not exclusively a cellular radio telephone system, comprising a host telephone and handset means containing a number assignment module (NAM) in which is stored a unique telephone number.

By way of background explanation, the cellular radio telephone system divides a geographical area into a plurality of adjoining cells each including a stationary transmitting and receiving base station connected to the conventional fixed-wire telephone network. Each cell is designed to allow a cellular telephone within the cell to access the fixed-wire network, and vice versa. Hence, the particular cell which receives the transmitting and/or receiving signal of a cellular telephone is the cell which is made operative for transmitting and/or receiving the call. So, for example, when a cellular telephone user attempts to make a call, the cell whose base station receives the strongest signal will be the one which effects the connection for that call. If the cellular telephone then moves beyond the effective range of the cell originally handling the call, another cell which receives the signal more strongly will become operative by an automatic transfer or 'hand-over' system. Hand-over may occur many times during a call depending on the distance travelled by the telephone and the number of effective cells through which the telephone passes.

Each cellular telephone includes a call-channel selector which controls a frequency synthesizer to span the available call channel frequencies and, in combination with a microprocessor, selects the call-channel received most strongly, i.e. from the cell base station closest to the telephone.

Cellular radio telephones fall into two main categories, namely mobiles and hand portables, although there is also an intermediate category known as transportables. As the name implies, a hand portable telephone is relatively lightweight and small in size and operates from an internal, rechargeable battery pack so that it may readily be carried around by the user. A mobile telephone, on the other hand, is permanently installed in a vehicle and operates from the vehicle's own (higher voltage) power supply. A mobile has the advantage over a hand portable that it can transmit at a higher power level, but a hand portable has the advantage that the user does not need to be in or near a vehicle to use the telephone, since it can be used anywhere within range of a base station. Unlike a mobile telephone, however, a hand portable does

have the drawback of having a limited stand-by and call time before the internal battery pack needs to be recharged. Thus, mobiles and hand portables each have their own particular benefits, and it is not uncommon for a subscriber to have both types of telephone, each with its own unique identity, that is to say the mobile telephone would have one telephone number and the hand portable would have a different telephone number, each with its own billing account. Alternatively, a hand portable telephone may be used in the vehicle with a special booster unit operated from the vehicle's power supply, but this involves additional apparatus and more expense.

Conventionally, each cellular telephone - whether mobile or hand portable - has its own unique telephone number by which it may be accessed from other cellular telephones or fixed-wire conventional telephones. The full telephone number is stored in a memory, e.g. a ROM, PROM or RAM known in the art as a 'number assignment module' (NAM) coupled to the control circuits, usually a microprocessor, of the cellular telephone. In the case of mobile telephones the NAM is traditionally contained in the so-called transceiver unit located in a convenient (usually concealed) place separate and remote from the handset, the handset being connected to the transceiver unit.

It is noted that the terms 'number assignment module' and 'NAM' as used herein encompass any memory means, not necessarily modular in form, nor dedicated to the NAM function, in which information pertaining to the identity of the telephone, specifically the telephone number, is stored.

U.S. Patent No. 4,677,653 and U.S. Patent No. 4,734,928 disclose an adapter for a cellular mobile telephone which converts the telephone to have any one of several different telephone numbers selected manually by the user. The adapter is provided with a plurality of number assignment modules (i.e. NAMs) in the form of respective ROMs, each storing a unique telephone number. The ROMs (or NAMS) are mounted on a main circuit board in a housing separate from the telephone unit. Each NAM is connected to a multi-position switch so that a selected one of the NAMS may be coupled to the microprocessor of the telephone to change the telephone number. These U.S. Patents essentially extend the concept of a cellular telephone having its own unique telephone number by teaching that each telephone may indeed be adapted to have several unique numbers, any one of which may be active (all the others being dormant) at any one time and the user would have a different billing account for each number.

Although the same principle could also be applied to hand portable telephones, the overriding doctrine remains to provide cellular telephones with exclusive telephone numbers, that is to say each telephone either has its own individual telephone number or a unique set of telephone numbers exclusive to that particular telephone.

In the neighbouring art of cordless radio telephones, British Patents Nos. 2,154,395 and 2,159,372 disclose an arrangement of handset and base unit, in which the base unit automatically generates and stores an identification code, and then transmits the same code to the handset over the air. The handset stores the code in memory. When an incoming or outgoing call is initiated, the two identification codes stored in the base unit and the handset, respectively, are compared and only if they match is the call allowed to proceed. The identification codes stored in the base unit and handset are thus provided for security purposes i.e. to prevent crosstalk and the risk of wire tapping in that they prevent a handset being used with any base unit other than its intended partner. Provision is made to enable a plurality of handsets to be operable with a common base unit, but each of the handsets can be used only with the particular base unit (or units) to which it is paired and no other. Moreover, in the case of cordless telephones it is noted that the base unit and the handset, although separate, constitute a single telephone and therefore only have one unique telephone number associated therewith. Furthermore, it is noted that this telephone number does not need to be stored in memory within any part of the telephone since the base unit is connected to the fixed-wire telephone network and hence can be addressed in the conventional manner. There is therefore no equivalent of a number assignment module in the case of a cordless telephone.

According to a first aspect of the present invention there is provided a radio telephone system comprising host radio telephone means and handset means dependant for operation on connection to the host radio telephone means, wherein the host telephone means is adapted to have the handset means removably connected thereto, characterized in that the handset means contains a number assignment module (NAM) in which is stored a number identifying the handset means, the handset means is adapted to provide read access to said NAM from outside the handset means, and the host telephone means is provided with means for accessing said NAM in the handset means whereby the host telephone means assumes automatically the identifying number of the handset means when the handset means is connected to the host telephone means.

In a radio telephone system in accordance with

the invention the handset means lends its own inherent identity (telephone number(s)) to the host telephone means while the handset means is temporarily connected to the host. Hence, a common host may be used by any number of different subscribers having their own handset means and they will each be able to make and receive calls on their own personal telephone numbers and the charges for using the system can be levied to the respective subscriber's billing account. Conversely, an individual subscriber may connect his personal handset means to any convenient host telephone means and he will be able to make and receive calls on his personal telephone number and, furthermore, the charges for using the system can be levied to his particular billing account.

The host telephone means may contain its own NAM and so be fully operable as a telephone in its own right with its own unique telephone number. Nevertheless, whenever a handset means containing its own NAM in accordance with the invention is connected thereto, the host will automatically assume the telephone number of the handset means regardless of its own inherent number.

In a preferred embodiment the radio telephone system includes means capable of detecting the connection of the handset means to the host telephone means, wherein the host telephone means comprises control circuitry to which the NAM of the host telephone means is coupled, and switching means responsive to the detecting means which disconnect the NAM of the host telephone means from the control circuitry when the handset means is connected to the host telephone means. The host thus behaves schizophrenically, resuming its own inherent telephone number when the handset means is disconnected, but assuming the identity of the handset means when the handset means is connected. Such a switching means is not, however, essential. Without it, the host telephone may operate with both telephone numbers simultaneously when the handset means is connected.

In one embodiment the host telephone may be arranged to read the NAM information directly from the handset means whenever the handset means is connected to the host. In an alternative embodiment, the host telephone comprises memory means for storing NAM information from the handset means, and means are provided for transferring information from the NAM of the handset means to the memory means automatically when the handset means is connected to the host.

Means may also be provided for erasing the information stored in the memory means automatically when the handset means is disconnected from the host. Fresh NAM information can thus be stored in the memory means the next time a handset means is connected to the host telephone.

Additionally, the handset means may comprise memory means for storing variable information, such as abbreviated dialling codes or frequently used telephone numbers entered by the subscriber, and the host telephone may comprise a corresponding memory, means being provided to download information from the memory means in the handset means to the corresponding memory in the host telephone automatically when the handset means is connected to the host telephone. Similarly, information may be transferred from the host telephone to the handset means.

According to another aspect of the invention there is provided host radio telephone means for use in the radio telephone system in accordance with the first aspect, adapted to have removably connected thereto a telephone handset means containing a number assignment module (NAM) storing a telephone number identifying the handset means, said handset means being dependant for operation on connection to the host telephone means, the host telephone means having means for accessing the NAM in the handset means whereby the host telephone means automatically assumes the identifying telephone number of the handset means when the handset means is connected to the host telephone means.

According to another aspect of the invention there is provided a telephone handset for use in the radio telephone system in accordance with the first aspect, adapted to be removably connected to the host telephone means and containing a number assignment module (NAM) for storing a telephone number identifying the handset, the handset means being dependant for operation on connection to the host telephone means and being adapted to provide read access to the NAM from outside the handset means.

Embodiments of the invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 illustrates schematically a cellular radio telephone system comprising interconnected mobile and portable telephones,

Figure 2 illustrates schematically an embodiment of the invention,

Figure 3 illustrates a radio telephone system similar to that in Figure 1, and

Figure 4 illustrates a further similar radio telephone system.

Referring to Figure 1, there is shown schematically a mobile cellular radio telephone 1 connected to a hand portable cellular radio telephone 2. As is conventional, the mobile telephone comprises a transceiver with R.F. circuits 16 connected to an external antenna 17 and coupled to a microprocessor 4. The mobile telephone has its own inherent telephone number by virtue of a NAM 14 contained

within the main unit of the mobile telephone. A dedicated handset 5 is connected to the main unit in known manner. However, unlike conventional mobile apparatus, the present mobile telephone has an external connector 3, e.g. an 18 pin socket 3, known per se, coupled to the microprocessor 4 of the mobile telephone by an internal data link 24 and the NAM 14 is coupled to the microprocessor 4 via a switch 15 as explained in more detail below.

The hand portable telephone 2 comprises its own microprocessor 6 and a NAM 7 coupled thereto containing the telephone number of the hand portable unit. The NAM 7 is connected by an internal data link 27 to an external connector 8, e.g. an 18 pin socket, on the outer casing of the hand portable telephone 2.

The hand portable and mobile telephones are mutually connected by a wire (electrical) data link 9 having plugs 10 and 11 at opposite ends which mate with sockets 3 and 8 in the mobile and hand portable telephones respectively. A conventional logical switch 12 within the hand portable telephone 2 detects when connection is made to the mobile telephone 1 and disables the R.F. circuits 13 of the hand portable so that the hand portable ceases to operate as an independent radio telephone. When the telephones 1 and 2 are disconnected the switch 12 reconnects the R.F. circuits so that the hand portable telephone 2 resumes normal operation.

When the two telephones 1 and 2 are connected as shown in Figure 1, the NAM 7 of the hand portable telephone 2 is coupled via a fixed-wire electrical datalink 9, to the microprocessor 4 of the mobile telephone 1. The microprocessor 4 thus has direct access to the telephone number information stored in NAM 7. Also, the NAM 14 of the mobile telephone 1 is coupled to the microprocessor 4 via a conventional logical switch 15 which detects whether or not a hand portable telephone 2 is connected. When the hand portable is connected the switch 15 is opened to disconnect internal NAM 14 so that the microprocessor 4 only has access to the information in the NAM 7 of the hand portable telephone 2, but not to the NAM 14 of the mobile 1. The mobile thus assumes the identity of the hand portable telephone. When the hand portable is disconnected, however, the switch 15 is closed to couple the internal NAM 14 to the microprocessor 4 whereby the mobile resumes its own inherent telephone number.

The hand portable telephone 2 may be used as the handset for the mobile, in which case the audio circuits (not shown) remain operational when the telephones are connected, and this avoids the need for using the dedicated handset 5. However, the hand portable unit may be inconvenient and cumbersome to use as a handset inside a vehicle,

because of its relatively heavy weight, fixed antenna, and trailing connector lead 9, in which case the dedicated handset 5, or a conventional so-called "hands-free" apparatus, permanently connected to the mobile unit 1, may be utilised. In this case the audio circuits of the hand portable telephone 2 may also be disabled when the two telephones are connected together.

Figure 2 shows an embodiment in which an ancillary handset 5' is removably connected to the mobile telephone 1 via a connector 10'. The handset 5' contains its own NAM 19 in which is stored an exclusive telephone number identifying the handset. Operationally this arrangement is analogous to the previous embodiment with the ancillary handset 5' taking the place of the hand portable telephone 2. Thus, when the handset 5, is connected, the mobile telephone 1 becomes operative with the telephone number in the handset NAM 19. In this case switch 15 is responsive to the connection of an ancillary handset, and disconnects NAM 14 when an ancillary handset 5' is connected.

In a modified version of the Figure 2 embodiment the NAM 14 and switch 15 within the mobile unit may be omitted, the microprocessor 4 simply having direct read access to the NAM 19 in the handset 5' whenever the handset is connected. The mobile unit 1 does not have a dedicated handset and can be regarded as a latent telephone in that it does not contain its own inherent identity and only becomes operable as a telephone when a handset containing its own NAM is connected thereto. This adds a new dimension of versatility to conventional mobile telephones since the same mobile unit can be used by any number of different subscribers equipped with appropriate NAM-containing handsets and the telephone as a whole assumes the identity of the particular handset which is connected for the duration of the connection.

It is noted that what is referred to herein as the mobile unit need not be contained within a single unitary housing. In particular the handset may be connected to a transceiver unit of the telephone via intermediate means, typically a cradle on which the handset is placed either when the telephone is not in use or when it is being used in a "handsfree" mode. The cradle is conventionally fixedly mounted within the passenger compartment of the vehicle for ready access to the handset, whilst the transceiver unit may be located in any convenient place within the vehicle, e.g. in the trunk or beneath one of the seats.

Figure 3 shows an arrangement in which the mobile telephone 1 also comprises a programmable memory 16 into which information from the NAM 7 in the hand portable telephone is downloaded automatically when the two telephones are

connected together. In this case the microprocessor 4 is coupled to the memory 16 rather than directly to the NAM 7. The NAM 14 and memory 16 are coupled to the microprocessor 4 via a switch 15 which detects whether or not a hand portable telephone is connected. When a hand portable is connected, NAM 14 is isolated and memory 16 is coupled to microprocessor 4 so that the mobile telephone assumes the identity of the hand portable telephone 2. When the hand portable telephone is disconnected, memory 16 is isolated and NAM 14 is coupled to the microprocessor 4 so that the mobile telephone resumes its own inherent telephone number. Also, when the hand portable telephone is disconnected the memory 16 may be erased under the control of the microprocessor 4.

As a variation to the Figure 3 embodiment, the handportable telephone 2 may be substituted by an ancillary handset containing its own NAM as described with reference to the previous embodiments.

Figure 4 shows a modification of the arrangement in Figure 3 wherein the hand portable telephone 2 additionally has a random access memory or RAM 20 coupled to microprocessor 6 and the mobile telephone 1 has a corresponding RAM 21 coupled to microprocessor 4. Variable data may be entered into RAM 20 by the user, e.g. abbreviated dialling codes, frequently dialled telephone numbers, or other data. When the telephones 1 and 2 are connected together the data in RAM 20 is compared with data already held in RAM 21. Those memory locations which are not duplicated may be transferred automatically from RAM 20 to RAM 21 via data link 9 in known manner. Hence the mobile telephone 1 may take on not only the telephone number but other data stored in the hand portable telephone without rekeying.

In view of the foregoing description it will be evident that various modifications may be made within the scope of the present invention. For example, it is not necessary for the NAM 14 to be disconnected from the microprocessor 4 when a handportable telephone or ancillary handset is connected to the mobile, since both NAMs may remain coupled whereby the mobile telephone may simultaneously have two (or more) telephone numbers. In this case the switch 15 may be dispensed with. On the other hand the switch 15 need not itself be capable of detecting when an external device is connected to the mobile. Instead this function may be carried out by independent detection means well known to the person skilled in the art and the switch would then operate in response to the detection means, and switching may be effected under software control for example by the internal microprocessor. Furthermore, the NAMs in the telephones or the ancillary handset are not

restricted to containing a single telephone number, but may contain several different numbers. As regards the data link between the two telephones this need not be a fixed-wire electrical link (as described), but may alternatively be an optical or radio data link.

Finally, it is noted that the invention is not limited to cellular radio telephone systems, but applies equally to any radio telephone system, for example the discrete area system known in the UK as CT2.

#### Claims

1. A radio telephone system comprising host radio telephone means (1) and handset means dependant for operation on connection to the host radio telephone means, (5'), characterized in that the host telephone means (1) is adapted to have the handset means (5') removably connected electrically thereto, the handset means (5') contains a number assignment module (NAM) (19) in which is stored a number identifying the handset means, the handset means (5') is adapted to provide read access to said NAM (19) from outside the handset means, and the host telephone means is provided with means for accessing said NAM (19) in the handset means whereby the host telephone means assumes automatically the identifying number of the handset means when the handset means is connected to the host telephone means.

2. A radio telephone system as claimed in claim 1, wherein the host radio telephone means (1) comprises a number assignment module (NAM) (14) in which is stored a telephone number identifying the host telephone means.

3. A radio telephone system as claimed in claim 2, including means (15) capable of detecting the connection of the handset means to the host telephone means, wherein the host telephone means comprises control circuitry (4) to which the NAM (14) of the host telephone means is coupled, and switching means (15) responsive to the detecting means which disconnect the first NAM of the host telephone means from the control circuitry when the handset means (5') is connected to the host telephone means (1).

4. A radio telephone system as claimed in any of claims 1 to 3, wherein the host telephone means (1) comprises re-programmable memory means (16) for storing information from the NAM (19) in the telephone handset means, and means are provided for transferring information from the NAM (19) in the telephone handset means to the memory means automatically when the handset means is connected to the host telephone means.

5. A radio telephone system as claimed in claim 3

and claim 4, wherein the switching means (15) of the host telephone means (1) couples the memory means (16) to the control circuitry (4) when the handset means (5,) is connected to the host telephone means.

6. A radio telephone system as claimed in claim 4 or claim 5, wherein means are provided for erasing the information stored in the memory means (16) automatically when the handset means is disconnected from the host telephone means.

7. A radio telephone system as claimed in any of the preceding claims, wherein the handset means (5') comprises memory means (20) for storing variable information, and the host telephone means comprises corresponding memory means (21), and means are provided for transferring information from the memory means in the handset means to the corresponding memory means in the host telephone means automatically when the handset means is connected to the host telephone means.

8. Host radio telephone means (1) for use in the radio telephone system claimed in any of the preceding claims, the host telephone means being adapted to have removably connected thereto a telephone handset means (5') containing a number assignment module (NAM) (19) storing a telephone number identifying the handset means, said handset means being dependant for operation on connection to the host telephone means, the host telephone means having means (3,24) for accessing the NAM in the handset means whereby the host telephone means automatically assumes the identifying telephone number of the handset means when the handset means is connected to the host telephone means.

9. Telephone handset means (5') for use in the radio telephone system claimed in any of claims 1 to 7, adapted to be removably connected to the host telephone means (1) and containing a number assignment module (NAM) (19) for storing a telephone number identifying the handset, the handset means being dependant for operation on connection to the host telephone means and being adapted to provide read access to the NAM (19) contained therein from outside the handset means.

Fig.1.

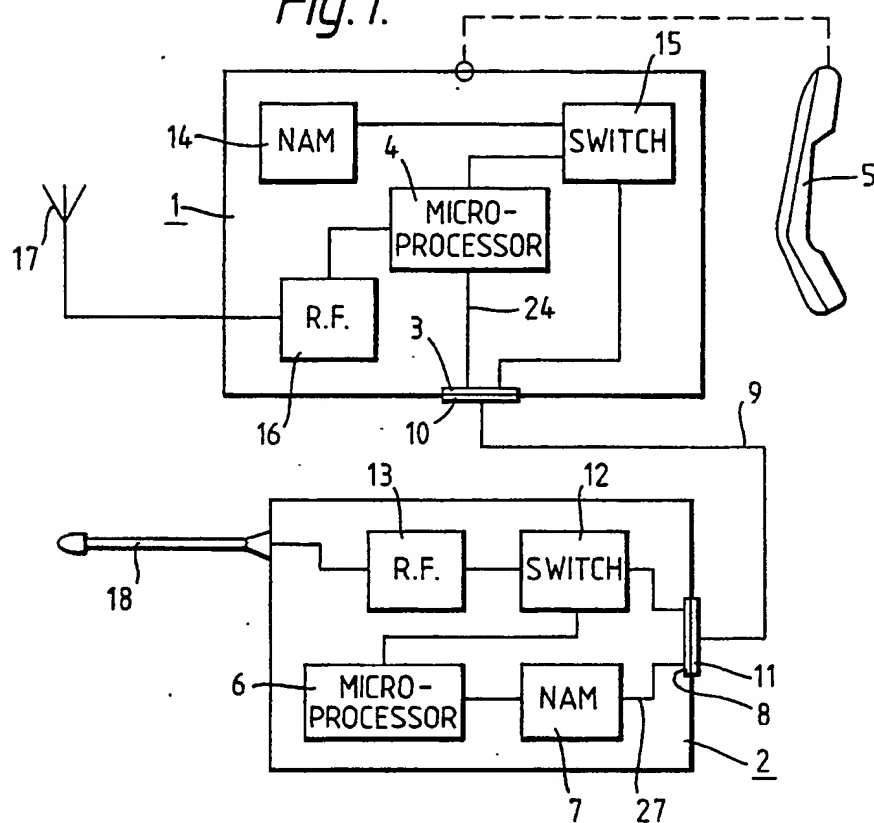


Fig.2.

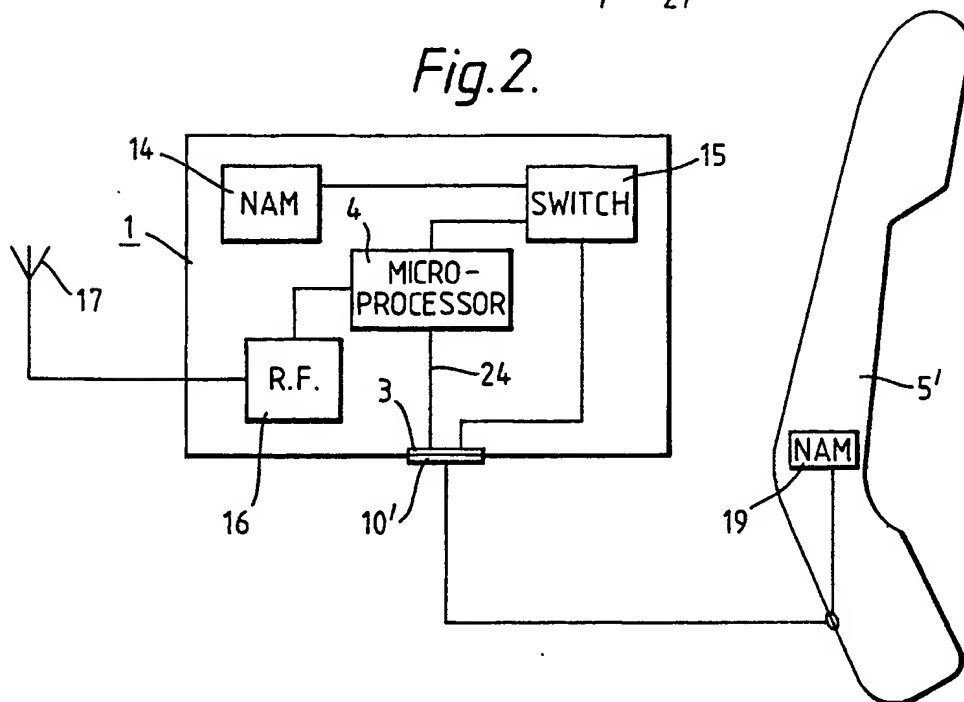


Fig.3.

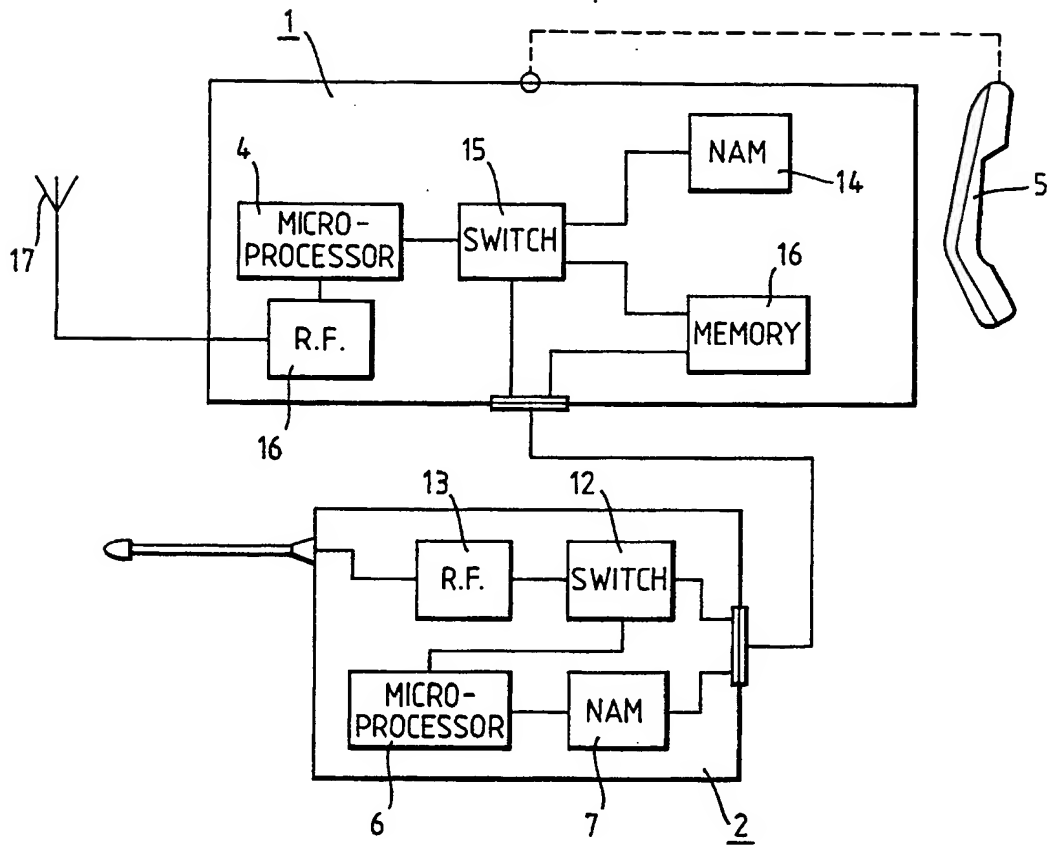




Fig.4.

